Technical Assistance Services *for* Communities

Ringwood Mines/Landfill Superfund Site

Fact Sheet – December 2018

Summary of Ringwood Mines/ Landfill Superfund Site Focused Feasibility Study (FFS) Report for Operable Unit 3 (OU3) Site-Related Groundwater

This fact sheet summarizes the Ringwood Mines/Landfill Superfund Site FFS Report published in September 2018. Technical comments are provided in the last section. This fact sheet is funded by the U.S. Environmental Protection Agency's (EPA's) Technical Assistance Services for Communities (TASC) program. Its contents do not necessarily reflect the policies, actions or positions of EPA.

The 500-acre Ringwood Mines/Landfill site is in a historic iron mining district in the Borough of Ringwood in Passaic County, New Jersey. Magnetite mines operated on site as early as the 1700s. In the late 1960s and early 1970s, Ford Motor Company disposed of paint sludge and other wastes on site. To manage the cleanup, EPA divided the site into operable units (OUs). OU1 was originally intended to comprehensively address the entire site. Later, EPA established OU2 and OU3. OU2 covers the land areas of concern known as the Cannon Mine Pit (CMP) Area, the O'Connor Disposal Area (OCDA) and the Peters Mine Pit (PMP) Area. See Figure 1. OU3 is sitewide groundwater and the St. George Pit Area.

The FFS Report has an executive summary and nine sections:

1. Introduction
2. Site Background and History
3. Groundwater Remedial Investigations Summary
4. Remedial Action Objectives
5. Applicable or Relevant and Appropriate Requirements (ARARs)

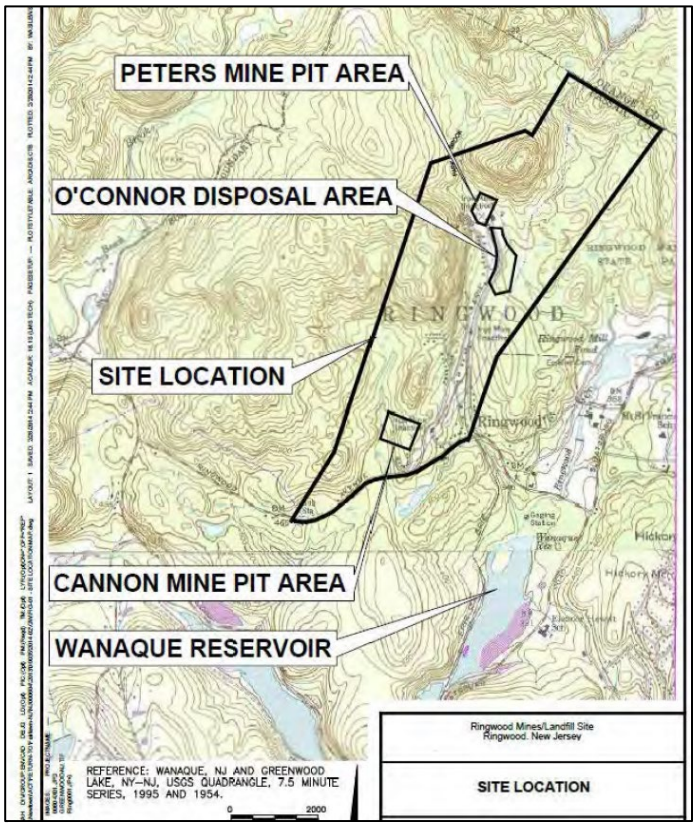

Figure 1. Ringwood Mines/Landfill Site Location (Figure 1, 2014 Record of Decision)

6. Identification and Screening of Remedial Technologies
7. Description of the Alternatives
8. Detailed Analysis of Alternatives
9. Comparative Analysis of Alternatives

Each section is discussed below.

1. Introduction

This section describes the report's purpose, scope and organization. The FFS Report evaluates remedial alternatives to address contaminants of concern (COCs) in groundwater and surface water. COCs at the site are benzene, 1,4-dioxane, chloroethane, arsenic, and lead.

An EPA-approved Candidate Technologies Memorandum selected the following alternatives (retained remedial alternatives) for detailed evaluation in the FFS Report:

Sitewide Groundwater:

(1) No Action
(2) Monitored Natural Attenuation (MNA) with a Classification Exception Area (CEA)/Well Restriction Area (WRA)

Sitewide Groundwater Focused on Combined PMP Area and OCDA:

(3) Enhanced MNA Treatment Barrier with a CEA/WRA

PMP Air Shaft:

(4) No Action
(5) Oxygen Diffusion via Chemical Addition
(6) Treatment/Closure

2. Site Background and History

This section provides an overview of the site setting and history. The site is located in the New Jersey Highlands, a mountainous part of northern New Jersey near the New York state border. The site is about 500 acres in size, a half-mile wide, and about 1.5 miles long. Bedrock is encountered at about 25 to 50 feet below ground surface (bgs).

Groundwater at the site occurs in the soil and rocks above bedrock if it is sufficiently thick (at least 8 feet thick) and in fractured bedrock. Groundwater in the soil and rocks above bedrock is considered an upper aquifer. Groundwater in the fractured bedrock is considered a lower, or deeper, aquifer. The direction of groundwater flow in both aquifers is generally to the southeast. Groundwater at the site is classified as a potential potable water source but it is not used as a potable water source. Potable water is water that is considered safe to drink, bathe in and use for cooking.

EPA has already selected remedies for OU2 and areas of concern (CMP Area, OCDA and PMP Area).

3. Groundwater Remedial Investigations Summary

This section summarizes the findings of the Site-Related Groundwater Remedial Investigation Report and Addendum, with a focus on information related to preparation of the FFS Report.

- Flow of groundwater/mine water and surface water at the site is understood.
- COCs in groundwater are generally sporadic and limited to localized former landfill areas.
- Natural processes are lowering concentrations of benzene, lead and arsenic.
- Groundwater and mine water at the site are somewhat distinct. The mine water is largely stagnant and subject to different conditions than groundwater.

Monitored Natural Attenuation: Monitoring of site conditions to make sure that natural processes to decrease or "attenuate" concentrations of contaminants in soil and groundwater are working.

Treatment Barrier: Placement of reactive materials underground through which contaminated groundwater must move as it flows. Treated water exits the other side of the barrier.

Oxygen Diffusion via Chemical Addition: Addition of oxygen release compounds (ORCs) that slowly release oxygen into the groundwater.

Biodegradation: Degradation or destruction of organic COCs by microorganisms in soil or groundwater. Organic COCs at the site are benzene, 1,4-dioxane and chloroethane.

Classification Exception Area: An institutional control that provides notice that there is groundwater pollution in a localized area caused by a discharge at a contaminated site.

Well Restriction Area: A restriction on the use of groundwater in an area where contaminant levels exceed state primary drinking water regulations.

- Wanaque Reservoir, Ringwood Borough wells, and potable wells at the Eleanor G. Hewitt School and Ringwood Manor State Park have not been impacted by site groundwater. The nearest potable well is at the state park, about three quarters of a mile from the site.

COCs in groundwater discharging to surface waters on site are generally not above their respective surface water quality standard (SWQS). In 2015, 2016 and 2017 sampling events, benzene was detected slightly above its SWQS at one sampling location in Park Brook, but the laboratory estimated those results, meaning it is somewhat uncertain that the benzene levels are above the SWQS. 1,4-Dioxane is detected in surface water within and beyond the site boundaries. It does not occur downstream of Sally's Pond above its groundwater quality standard (GWQS). The New Jersey Department of Environmental Protection (NJDEP) has not developed an SWQS for 1,4-dioxane.

The Site-Related Groundwater Remedial Investigation Report and Addendum conclude that:

(1) No individual, distinct source of any COC has been found in groundwater within the PMP Area and/or the PMP Air Shaft mine structure and associated mine workings.
(2) There is no complete exposure pathway.
(3) Potential risk to a hypothetical future resident is not significant, if groundwater were ever used as a potable resource or for domestic use.

4. Remedial Action Objectives

Remedial action objectives for site-related groundwater include:

- Prevent consumption of groundwater with COC concentrations above their respective NJDEP GWQS.
- Prevent exposure to COC groundwater concentrations, which would exceed EPA's risk benchmarks. EPA's cancer benchmark is an additional lifetime cancer risk range between one in a million and one in 10,000. EPA's noncancer benchmark is a lifetime noncancer hazard index of less than 1.0. A noncancer hazard index of less than 1.0 indicates that no noncancer health effect is expected.
- Restore the aquifer to GWQSs for potable water use within a reasonable timeframe, and to the extent practicable for site-related COCs.

5. Applicable or Relevant and Appropriate Requirements (ARARs)

ARARs are state, federal and local regulations and guidance that must be complied with when remediating a Superfund site. At this site, ARARs include federal and state regulations for air, water and hazardous wastes. The Clean Air Act and the Clean Water Act are examples of site ARARs. See Table 10 of the FFS Report for a list of all site ARARs.

6. Identification and Screening of Remedial Technologies

This section summarizes screening of remedial technologies. Screening led to the selection of the retained remedial alternatives evaluated in the FFS. Technologies to remediate groundwater in each of the three land areas of concern were screened. The sitewide alternatives screened include no action, MNA and enhanced MNA. For these technologies, a CEA/WRA is required to comply with NJDEP regulations. The no action alternative is required to provide a baseline for comparisons of alternatives.

Additional technologies were screened for the PMP Area groundwater, air shaft and associated mine workings. Technologies to treat groundwater downgradient (in the direction of groundwater flow) of the PMP Area included a downgradient treatment barrier, in-situ chemical oxidation (ISCO), air sparging/soil vapor extraction, and groundwater pumping and treatment.

The treatment barrier would increase dissolved oxygen in groundwater. This could help microorganisms biodegrade the organic COCs and also increase the precipitation of iron and arsenic from a dissolved state to a solid state. ISCO is the injection of a chemical, such as hydrogen peroxide, to destroy organic COCs in groundwater through a chemical process called oxidation. Air sparging is the injection of air into groundwater to cause volatile organic chemicals such as benzene to vaporize. Soil vapor extraction pulls air containing the released vapors from the soil above the groundwater and treats it to remove the COCs.

Technologies screened to treat mine water in the PMP Area air shaft included oxygen diffusion via chemical addition, ISCO, biosparging, and permanent closure of the air shaft with addition of granulated activated carbon (GAC) and resin at the base of the shaft. Biosparging is the injection of air into the groundwater to provide more oxygen for microorganisms that can biodegrade the organic COCs. GAC and resins could decrease benzene and 1,4-dioxane levels in the PMP Area air shaft by adsorbing these chemicals.

7. Description of the Alternatives

This section describes the remedial alternatives resulting from the technology screening and retained for the detailed evaluation. Retained remedial alternatives are the ones listed in the first column on page 2 of this fact sheet.

MNA would include groundwater monitoring at locations where COCs are above their respective GWQSs, as well as at sentinel monitoring wells where COCs are below GWQSs or not detected. The FFS indicates that monitoring would include many existing wells along with new sentinel wells. The FFS Report recommends sampling twice the first year, once every five quarters (15 months) for the second through fifth years, and every two years thereafter. The monitoring program would also include surface water monitoring.

8. Detailed Analysis of Alternatives

This section provides a detailed evaluation of each retained remedial alternative against the criteria established in the National Contingency Plan (NCP). The NCP is the federal government's guide for responding to oil spills and hazardous substance releases.

EPA must consider nine criteria when making a remedy decision. The first two criteria, listed below, are called threshold criteria.

- Overall protection of human health and the environment.
- Compliance with ARARs.

To be eligible for selection, a cleanup alternative must meet threshold criteria.

The next five criteria are primary balancing criteria. These criteria assess the relative advantages and disadvantages of each alternative. Balancing criteria are all considered without assigning priority to any one of them. The five criteria are:

- Long-term effectiveness and permanence – evaluation of how effective the alternative will be over time.
- Reduction in toxicity, mobility or volume – evaluation of whether any treatment can permanently reduce the toxicity, mobility (ability of a contaminant to move in the environment) or volume of a contaminant.
- Short-term effectiveness – evaluation of the short-term risks to workers and nearby people during remedy construction.
- Implementability – evaluation of the likelihood of successfully putting the remedy in place.
- Cost – evaluation of the cost of each alternative. The expected accuracy of the estimate is usually plus 50 percent and minus 30 percent.

The FFS Report evaluates these seven threshold and balancing criteria before EPA's selection of a preferred cleanup alternative.

The final two evaluation criteria are called modifying criteria. They are:

- State acceptance.
- Community acceptance.

The modifying criteria allow for consideration of state and community issues. EPA evaluates them after selecting a preferred cleanup alternative based on the first seven evaluation criteria. EPA will select a preferred cleanup alternative and explain it in a document called a Proposed Plan. The Proposed Plan will be released for public comment. After receiving comments from the state, the community and other site stakeholders, EPA may modify the Proposed Plan before issuing a Record of Decision (ROD). The ROD is a legally binding document that outlines how the Superfund site will be cleaned up.

9. Comparative Analysis of Alternatives

This section compares the remedial alternatives using the results of the detailed evaluation in Section 8. Tables 1 and 2 summarize comparative results from the FFS Report.

Table 1: Sitewide Groundwater Remedial Alternatives Comparative Results							
Alternative	**Overall Protection**	**Compliance with ARARs**	**Long-term Effectiveness**	**Reduction in Toxicity, Mobility or Volume**	**Short-term Effectiveness**	**Implementability**	**Cost**
Sitewide Groundwater							
1. No Action (CEA/WRA required by NJDEP even with no action)	Currently protective	Complies with ARAR to control groundwater use by CEA/WRA	Effective through maintenance of CEA/WRA	None	No short-term impacts; up to two months to implement CEA/WRA	Readily implementable	$622,000
2. MNA with CEA/WRA	Currently protective and more robust future protection	Designed to meet GWQSs over time; NJDEP permit equivalent application process required	Effective through maintenance of CEA/WRA	Reduces toxicity and mobility of COCs	No significant impacts; about six months to construct	Readily implementable	$1,439,000
Sitewide Groundwater Focused on Combined PMP Area and OCDA							
3. Enhanced MNA Treatment Barrier with CEA/WRA	Currently protective and more robust future protection	Designed to meet GWQSs over time; NJDEP permit equivalent application process required	Effective through maintenance of CEA/WRA	Further reduces toxicity and mobility of COCs compared to Alternative 2	No significant impacts; about 12 to 18 months to construct	Readily implementable	$2,815,000

Table 2: PMP Air Shaft Remedial Alternatives Comparative Results*							
Alternative	**Overall Protection**	**Compliance with ARARs**	**Long-term Effectiveness**	**Reduction in Toxicity, Mobility or Volume**	**Short-term Effectiveness**	**Implementability**	**Cost**
4. No Action	Currently protective	Not applicable	Not a permanent remedy	None	None	Not a consideration	None**
5. Oxygen Diffusion via Chemical Addition	Currently protective	Would comply through NJDEP permit equivalent application process	Not a permanent remedy, but ORC can be in place indefinitely	Would reduce COC toxicity and volume by biodegradation	No significant impacts; about six to 12 months to construct	Readily implementable	$334,000
6. Treatment/ Closure	Currently protective	Would comply through permit NJDEP equivalent application process	Permanent remedy	Would reduce COC mobility with GAC and resin	No significant impacts; about 12 to 18 months to construct	Readily implementable	$598,000
* Alternative 4, 5 or 6 would be added to the selected sitewide groundwater remedial alternative of 1, 2 or 3. ** Cost of CEA/WRA would be included in the selected sitewide groundwater remedial alternative of 1, 2 or 3.							

TASC Comments

TASC staff reviewed the FFS Report. The following technical comments are based on TASC's independent review and are provided for the use of the Community Advisory Group (CAG) and community members. TASC does not submit comments to EPA on behalf of the CAG or community. The comments reflect the opinions of the reviewers and may not reflect the policies, actions or positions of EPA.

- ***Use of site groundwater***. In Section 3.2.1, on page 14, the FFS Report states: "The data generated during the RI have confirmed that groundwater is not used for potable or domestic purposes at the Site." This sentence references a November 2016 EPA fact sheet that states that the water is not used for drinking. The CAG may want to confirm with EPA that site groundwater is still not being used for drinking.

- ***Possible additional monitoring wells previously discussed by TASC***. When TASC reviewed the intermediate groundwater monitoring plan in the Remedial Design Report for OU2, TASC recommended that the community ask about some additional monitoring well locations. See the TASC fact sheet, Summary of Ringwood Mines/ Landfill Superfund Site Final Remedial Design Report for Operable Unit 2 (OU2). The FFS Report recommends several additional monitoring well locations, including those identified by TASC, except for RW-9A. The only COC above its GWQS in this well was arsenic. Arsenic was found at levels only slightly exceeding its GWQS of 3 micrograms per liter (µg/L). However, the well seems to be one of the shallowest wells near the CMP Area. The CAG may want to ask for the inclusion of RW-9A in the monitoring program due to its arsenic detections above its GWQS and its shallower depth in the CMP Area. If there were any remaining source in the CMP Area and it leached into groundwater, contamination would most likely reach the shallower wells, such as RW-9A, before the deeper ones.

- ***FFS Report recommended groundwater and surface water monitoring.*** Overall, the proposed groundwater and surface water monitoring program is reasonable and provides good coverage across the site, at varying depths and locations. However, the CAG may want to ask for the following additions to the monitoring program:
  - *RW-9A* – as explained in the preceding bullet.
  - *SR-3 Seep 2* – concentrations of benzene and 1,4-dioxane were greater than reported for the SR-3 Seep 1 during February 2017 sampling. The SR-3 Seep 1 is included in the monitoring program. Seep 2 is not.
  - *An additional location downgradient of overburden well OB-17 in the OCDA* – because Well OB-17 continually reports 1,4-dioxane above its GWQS of 0.4 µg/L. The February 2017 detection was 16 µg/L.
  - Plans for additional sentinel wells further downgradient if 1,4-dioxane or another COC is identified in any of the new sentinel bedrock wells proposed in the FFS Report.

- ***Monitoring well OB-18***. Page 73 of the FFS Report does not identify overburden well OB-18 as a proposed well for the monitoring program for the OCDA. However, Figure 23 does identify it as a sentinel well for the monitoring program. The CAG may want to ask EPA for confirmation that OB-18 is included in the monitoring program, particularly given its location next to OB-17, where 1,4-dioxane is frequently detected above its GWQS.

- ***Enhanced MNA treatment barrier***. The FFS Report states that the treatment barrier would consist of placing solid ORCs in wells to release oxygen into the groundwater to increase biodegradation. The wells would be installed in the overburden (upper aquifer, above bedrock) in a barrier-style

configuration perpendicular to the direction of groundwater flow. It would be tested in bedrock wells, but the released oxygen may not move well enough in the bedrock groundwater. This technology is well-established for treating organic chemicals such as benzene and it shows potential for treating 1,4-dioxane. The FFS indicates that there may not be microorganisms present onsite that can degrade 1,4-dioxane. The CAG may want to ask EPA if an appropriate bacterial culture to biodegrade 1,4-dioxane could also be tested along with the ORCs if Alternative 3 is selected.

Page 77 of the FFS Report identifies a few commercial additives: ORC Advanced®, PermeOx® and EHC-O®. ORC Advanced® (https://regenesis.com/en/treatable-contaminants) and PermeOx® (http://www.peroxychem.com/chemistries/calcium-peroxide/products/permeox-ultra) do not list 1,4-dioxane in their list of treatable contaminants. No specific contaminant information was found for EHC-O®. The CAG may want to ask EPA if and how different commercial additives will be tested for effectiveness if Alternative 3 is selected.

- ***Figures 5 through 14***. The statement on page 21 of the FFS Report, "These figures depict monitoring data for the two most recent Sitewide sampling events in 2016 and 2017, with the highest concentration from the two events used to prepare the figures" may not be accurate. All report figures include a disclaimer that the August 2016 data were used to create the maps. The CAG may want to ask EPA for clarification regarding which data are presented in these figures.

- ***Figures 15 and 16***. The text on page 21 of the FFS Report states that the isoconcentration mapping shown in Figures 15 and 16 indicates that COCs are contained on site and do not extend off site in groundwater above their GWQSs. However, it is not completely clear to TASC that COCs are contained on site. The status of on-site containment will be known after additional bedrock wells (particularly downgradient of wells RW-15S and RW-15D) are installed and sampled. The CAG may want to ask EPA to confirm that COCs are contained on site after the additional bedrock wells are installed and sampled.

- ***Remedial Action Objectives***. One of the remedial action objectives in Section 4 of the FFS is to restore the aquifer to Class IIA GWQS within a reasonable time frame, and to the extent practicable for site-related COCs. The CAG may want to ask EPA what it considers to be a reasonable timeframe and whether a time limit will be established when a remedy is selected.

- ***Significance of human health risk***. The FFS states in several places that the potential human health risks associated with site COCs in groundwater and surface water are not significant. On page 15, the FFS states that "potential risk to a hypothetical future resident is not significant, if groundwater was ever used as a potable resource or for domestic use". The CAG may want to ask EPA if it agrees with this assessment of human health risk.

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